

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

WASTEWATER TREATMENT STRIP

(Ac.)

CODE 635

DEFINITION

A treatment component of an agricultural waste management system consisting of a strip or area of herbaceous vegetation.

- To the treatment of contaminated runoff from such areas as feedlots, barnyards, and other livestock holding areas
- To the treatment of dilute wastewater such as milk house effluent and diluted silage leachate

PURPOSE

The purpose of this practice is to improve water quality by reducing loading of nutrients, organics, pathogens, and other contaminants associated with animal manure and other wastes, and wastewater by treating agricultural wastewater and runoff from livestock holding areas with:

- Rapid infiltration
- Overland flow
- or
- The slow rate process

CONDITIONS WHERE PRACTICE APPLIES

This practice applies:

- Where a treatment strip is a component of a planned agricultural waste management system
- Where a treatment strip can be constructed, operated and maintained without polluting air or water resources

CRITERIA

General Criteria Applicable To All Purposes

The installation and operation of the wastewater treatment strip shall comply with all federal, state, and local laws, rules, and regulations.

Inflow to wastewater treatment strips shall be pretreated as appropriate ***to remove solids, sediment or flocculated material.***

Discharge to and through treatment strips shall be as sheet flow. Some means, such as a ditch, curb, or gated pipe, shall be provided to disperse concentrated flow and ensure sheet flow across the width (dimension perpendicular to flow length) of the treatment strip. Land grading and structural components necessary to maintain sheet flow throughout the length (dimension parallel to the flow) of the treatment strip shall be provided as necessary.

Permanent herbaceous vegetation consisting of a single species or a mixture of grasses, legumes and/or other forbs adapted to the soil and climate shall be established in the treatment strip. Vegetation shall be able to withstand anticipated wetting and/or submerged conditions.

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Soils with fragmented bedrock or bedrock within 12" of the surface shall not be considered for filter strips.

Clean water shall be diverted from the treatment strip to the fullest extent possible unless needed to promote vegetation growth in the treatment strip. ***Clean water runoff not diverted shall be included in the design of the treatment strip and components.***

Treatment strips should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger if required by law.

Treatment strips shall not be located within 30' of the top of bank of a permanent or intermediate stream, spring, or open sink and shall not be located within 100' of a well.

Designs shall be based on the latest edition of the Environmental Protection Agency Technology Transfer Process Design Manual for Land Treatment of Municipal Wastewater; ***updated by the Dept. of Army, USACE EM1110-1-501, May 20, 1982*** or other technically acceptable reference.

Additional Criteria For Rapid Infiltration Treatment

Rapid infiltration treatment refers to a specific remediation technique that utilizes the filtering capabilities of moderately and highly permeable soils (***permeability of 0.6-2.0 in/hr. and greater***). ***It is not for areas that are considered karst, high recharge or on soils documented as having a high water table.***

Treatment for this purpose shall consist of directing wastewater or contaminated runoff from a livestock holding area into a uniformly graded strip or area of herbaceous vegetation and allowing it to flow over and infiltrate the treatment strip ***to a depth not to exceed the average crop/grass rooting depth.*** This ***rapid infiltration*** method is not appropriate for treatment of wastewater containing high concentrations of nutrients, such as runoff from uncovered waste storage facilities.

Contaminated runoff shall be pretreated by solid/liquid separation utilizing a facility such as a settling basin prior to discharge of liquid to the treatment strip.

The treatment strip shall be a uniformly graded strip or wide bottomed trapezoidal channel.

The treatment strip design shall be based on the runoff volume from the 25-year, 24-hour storm event from the livestock holding facility. It may be designed to infiltrate a portion or the entire volume of the design storm. This determination will be based on management objectives. The portion of the design volume not infiltrated shall be transferred to a storage facility unless discharge is permitted by applicable regulations.

The treatment strip's area requirements shall be based on the soil's capacity to infiltrate and retain runoff within the root zone and the vegetation's capability to utilize the nutrient loading. The soil's ability to infiltrate and retain runoff shall be based on its water holding capacity in the root zone, infiltration rate, permeability, and hydraulic conductivity. This determination shall be based on the most restrictive soil layer within the root zone regardless of its thickness.

The anticipated nutrient loading shall not exceed the vegetation's agronomic nutrient requirement.

The infiltration strip design shall be such that the upper soil profile remains unsaturated except during storm events and returns to an unsaturated condition within two days following storm events. The water table shall be either naturally deep enough (***a min. of 24"***) or artificially lowered so that the infiltrated runoff does not mingle with the native ground water. Infiltration strips shall not be planned where soil features such as cracking ***or high shrink-swell***, will result in preferential flow paths that transport untreated runoff from the surface to below the root zone.

Additional Criteria For Overland Flow Treatment

Overland flow treatment refers to a specific microbial remediation technique that has minimal infiltration of wastewater. Treatment by

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overland flow shall consist of the application of wastewater along the upper portion of a uniformly sloped strip of herbaceous-vegetation, allowing it to flow over the vegetated surface for aerobic treatment to a collection ditch.

The design hydraulic loading rate and application rate shall be selected based on consideration of the anticipated levels of pretreatment, quality of effluent, temperature, and other climatic conditions. A maximum hydraulic loading rate of 2.0 inches per day and an application rate of eight gallons per hour per foot of slope width shall be used unless higher rates can be justified by on-site studies.

The application period shall not exceed 12 hours per day and the application frequency not exceed 5 days per week unless longer application periods and frequencies can be justified based on local conditions. ***For applications with continuous or daily runoff (not associated with normal rainfall), a minimum of two separate overland flow treatment areas shall be developed.***

The nutrients anticipated to infiltrate the treatment strip shall not exceed the vegetation's agronomic nutrient requirement.

Overland flow treatment shall be constructed on soils with low permeability (***soils with very slow or slow hydraulic conductivity rates are typically Hydrologic Soil type C or D***). The design shall be based on the most restrictive soil layer within the root zone. ***Refer to your specific county soil survey "Table for Physical and Chemical Properties of the Soils" for soil permeability information.*** The maximum allowable permeability shall be 0.2 inches per hour unless a natural or constructed barrier within the soil profile mitigates the potential of ground water contamination.

The minimum slope length for the applied wastewater shall be 100 feet.

The sloped areas to receive wastewater shall be uniformly graded to eliminate wastewater ponding and short-circuiting for the length of the flow. Slopes shall be equal to or greater than 2.0% but shall not exceed 8.0%.

Wastewater discharged from the treatment strip shall be transferred to a waste storage facility, a waste treatment lagoon, or other facility for

further treatment and/or utilization unless discharge is permitted by regulations.

Overland Flow Treatment Exception for Winter Applications

Concrete winter feeding pads (refer to NRCS-CPS Heavy Use Area Protection (561)) designed for 10 animal units or less that have tainted (water/rainfall that comes in contact with animal manures) may consider an overland flow waste treatment strip for treatment, provided the manure from the pad is regularly scrapped into a covered waste storage facility (NRCS-CPS Waste Storage Facility (313)).

Winter (soil temperature is below 40 deg. F., ground is frozen, saturated or snow covered) treatment of tainted water onto an overland flow wastewater treatment strip/area shall not be permitted for un-roofed concentrated animal feed areas with over 10 animal units/24 hour period.

The nutrients anticipated to infiltrate the treatment strip shall not exceed the vegetation's agronomic nutrient requirement.

For winter application of wastewater, a minimum time of concentration of 15 minutes shall determine minimum flow length, but in no case shall it be less than 100'. If there is no downslope containment area, then the lower end of the wastewater filter strip shall be a minimum of 30' from the top of an intermittent stream, ditch bank and/or 25 yr. flood elevation.

Additional Criteria For Treating Wastewater With The Slow Rate Process

The slow rate process refers to a specific remediation technique involving the application of wastewater to a vegetated surface for treatment as it flows down through the plant-soil matrix.

The design hydraulic loading shall be based on the more restrictive of two limiting conditions – the capacity of the soil profile to transmit water (soil permeability) or in the nitrogen concentration in the water percolating below the root zone. The percolate nitrate-nitrogen concentration leaving the root zone shall not exceed 10 mg/L. The anticipated nutrient

loading shall not exceed the vegetation's agronomic nutrient requirement.

Storage shall be provided when the amount of available wastewater exceeds the design hydraulic loading rate or for strip non-operating periods.

Wastewater shall be applied to the treatment strip utilizing a method that will result in an even application of the entire strip and a rate that does not exceed the infiltration rate of the soil.

CONSIDERATIONS

- More than one overland flow treatment strip should be considered to allow for resting, harvesting vegetation, maintenance, and to minimize the potential for overloading.
- Consider pretreating overland flow influent with solid/liquid separation to reduce organic loading, odor generation, and maintenance requirements
- Consider suspension of application to treatment strips when weather conditions are not favorable for aerobic activity or when soil temperatures are lower than 39° F. When soil temperatures are between 39° F and 50° F reduction of application rate and increased application period while maintaining the hydraulic loading rate constant should also be considered.
- ***Locate treatment strip on south slope to encourage vegetative growth and rapid soil warming.***
- ***Locate treatment strip on contour to reduce overland flow slope and improve maintenance.***

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Plans should include information about the ***source of treatment material, volume of material to be treated, type of overland flow treatment***, location, construction sequence, and vegetation establishment.

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Specifications will include:

- Length, width, and slope of the treatment strips to accomplish the planned purpose (length refers to flow length down the slope of the treatment strip).
- Annual crop, acreage and anticipated nutrient application and uptake.
- Herbaceous species and seed selection, and seeding rates to accomplish the planned purpose.
- Planting dates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival.
- Statement that only viable, certified weed free, high quality, and regionally adapted seed will be used.
- Site preparation sufficient to establish and grow selected species.
- ***Specify type of fencing or barrier necessary to eliminate livestock access to area.***
- ***Anticipated dates that the waste strip will be in use.***
- ***Document the source of nutrients and maximum allowable planned application rate.***
- ***Document type or combination of types of treatment area (Overland Flow, Rapid Infiltration, Overland Flow Treatment, Slow Rate Process) and any other additional treatment necessary (WSF 313, etc.).***
- ***Construction sequence of treatment area and other related conservation practices.***

REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Wastewater Treatment Strip - 635.
- National Engineering Handbook (NEH), Part 651, Agricultural Waste

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Management Field Handbook
(AWMFH)

- N RCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook
- 210-VI-EFH Amend. 45, WV5 Preparation of Engineering Plans
- 210-V-NEM Part 505 – Non-NRCS Engineering Services
- WV Engineering Field Handbook
- EPA Technology Transfer Process Design Manual for Land Treatment of Municipal Wastewater
- Penn State “The Agronomy Guide 1997-1998

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OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The plan shall include the following as appropriate:

- Harvest treatment strip vegetation as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue
- Control undesired weed species, especially state-listed noxious weeds.
- Inspect and repair treatment strips after storm events to fill in gullies, remove flow disrupting sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of herbaceous vegetation.
- Maintain or restore the treatment strip as necessary by periodically grading when deposition jeopardizes its function, and then reestablishing to herbaceous vegetation.
- Use of alternating treatment strip
- Routinely de-thatch and/or aerate treatment strips used for treating runoff from livestock holding areas in order to promote infiltration
- Conduct maintenance activities only when the treatment strip is dry and moisture content in the surface soil layer will not allow compaction
- Prevent grazing in treatment strips ***and exclude livestock from strip other than to remove forage to a designated maintenance height. This “flash” grazing should occur infrequently during the growing season to reduce the chance of depositing excessive nutrients.***
- Treatment strips in arid or semiarid regions that potentially could be affected by high salinity and/or sodicity (sodium content) should be monitored for excessive salt and sodium buildup. If found to be excessive, an appropriate corrective action shall be taken.
- ***Conduct maintenance inspection on the waste source system and clean, repair or replace as necessary.***

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